NASA Grant
Grant # NCC2-453
Principal Investigator: F. Alberto Grunbaum
Conference Coordinator: Robert Grossman

Final Report
A Symposium on the Use of Symbolic Methods to Solve Algebraic and Geometric Problems Arising in Engineering

Robert Grossman
Department of Mathematics
University of California, Berkeley
Berkeley, CA 94720

August 25, 1987

Introduction

This is the final report on a Symposium on the Use of Symbolic Methods to Solve Algebraic and Geometric Problems Arising in Engineering, sponsored by the Ames Research Center of the National Aeronautics and Space Administration, and held at the NASA-Ames Research Center, Moffett Field, California, on January 15 and 16, 1987.

Approximately eighty five engineers, mathematicians and computer scientists attended one or more of the eight sessions during this two day workshop. Eight major talks were given, with each followed by a lively discussion session.

As a result of the workshop several new collaborations were formed and much hard to get information was exchanged. Although no consensus was formed on the theme of the workshop, "How to develop better data structures and algorithms for the noncommutative algebraic and geometric structures that arise in engineering," many of the participants offered unsolicited praise of the workshop because of how valuable they found it for their own research. The proceedings of the workshop will be published by SIAM and should prove to be a important tool for workers in this area.

The following paragraphs contain a list of the speakers and the participants and a description of the proceedings.

Speakers

There were eight sessions, each consisting of a talk lasting from an hour to an hour and a half followed by a half hour of discussion.

H. Abelson and G. Sussman
Massachusetts Institute of Technology
Dynamicist's Workbench

G. Blankenship
University of Maryland, College Park
Symboic Algebraic Methods in Robotics

P. Colella
Lawrence Livermore National Laboratory
Fluid Computations and FIDIL

R. Fateman
University of California, Berkeley
Incorporating Operator Manipulation Primitives in Macsyma-like Systems: Prospects and Pitfalls

R. Grossman
University of California, Berkeley
Symbolic Computations of Higher Order Derivations

P. S. Krishnaprasad
University of Maryland, College Park
Applications of Computer Algebra Programs in Nonlinear Control and Filtering Problems

A. Odlyzko
AT&T Bell Laboratories
Some Applications of Symbolic Mathematics in Mathematics

R. Rand
Cornell University
Perturbations Methods, Bifurcation Theory and Computer Algebra

Proceedings

SIAM will publish the proceedings in their series, "Frontiers in Applied Mathematics." The title is "Advances in Symbolic Mathematics," and Robert Grossman will be the editor. All of the speakers, except for A. Odlyzko, will be submitting papers sometime before December, 1987. The proceedings should appear approximately four months after that. The proceedings will contain seven research-expository papers, a tutorial paper and a problem section containing research problems.

Memorandum of Understanding

The workshop was run pursuant to the memorandum of understanding between the University of California Coordinating Committee on Nonlinear Science and the NASA - Ames Research Center concerning a Joint Program in Nonlinear Science. The California Coordinating Committee on Nonlinear Science provided support so that graduate students and faculty members from the University of California could attend the workshop as detailed in the paragraph below.

Support of University of California faculty and graduate students

A grant from the University of California Coordinating Committee on Nonlinear Science provided travel support so that the following graduate students could attend the workshop

1. Chang, Tsu-Shuan
   University of California, Davis

2. Frezza, Rugero
   University of California, Davis

3. Karahan, Sinan
   University of California, Davis

4. Keeler, Jim
   University of California, San Diego

5. Nichols, William
   University of California, San Diego

6. Thomas, Oran
   University of California, San Diego

7. Wang, Shi-Ho
   University of California, Davis

8. Yang, Yumin
   University of California, San Diego

as well as the following University of California faculty members

1. Arthur Krener
   University of California, Davis

2. Marcus, Marvin
   University of California, Santa Barbara.

Other Sponsors

The workshop was also sponsored by the SIAM Activities Group in Control and Systems Theory. Because of their support control theorists were well represented at the workshop. Two of the sessions were devoted to the interaction of control theory and the theme of the workshop.

Participants

Forty-six engineers, computer scientists and mathematicians from univerisites, industry and government laboratories registered for the workshop. Their names are below. In addition approximately forty to fifty engineers and scientists from NASA-Ames attended one or more sessions, but did not register.

1. Abdali, S. Kamal
   Tektronix, Inc.

2. Abelson, Hal
   Massachusetts Institute of Technology

3. Andreoli, Dorothy
   University of California, Berkeley

4. Abarbanel, Henry
   University of California, San Diego

5. Balaban, David
   Lawrence Livermore National Laboratory

6. Blankenship, Gilmer
   University of Maryland, College Park

7. Behtash, Saman
   University of California, Berkeley

8. Breban, Michael
   Yeshiva Univerisity

9. Bronstein, Manuel
   University of California, Berkeley

10. Chang, Tsu-Shuan
    University of California, Davis

11. Chapman, Gary
    NASA - Ames

12. Colella, Phil
    Lawrence Livermore National Laboratory

13. Cuccia, Nicholas
    University of California, Berkeley

14. Einwohnen, Thomas
    Lawrence Livermore National Laboratory

15. Fateman, Richard
    University of California, Berkeley

16. Frezza, Rugero
    University of California, Davis

17. Garbarini, Joe P., Jr.
    Lawrence Livermore National Laboratory

18. Greiman, William H.
    Project Technology, Inc.

19. Grossman, Robert
    University of California, Berkeley

20. Grunbaum, Alberto
University of California, Berkeley

21. Robert Hermann
NASA - Ames

22. Jain, Pramod
University of California, Berkeley

23. Kahan, William
University of California, Berkeley

24. Karahan, Sinan
University of California, Davis

25. Keeler, Jim
University of California, San Diego

26. Krener, Arthur
University of California, Davis

27. Kenne, Peteris Emils
Australian National University

28. Krishnaprasad, P. S.
University of Maryland, College Park

29. Larson, Richard
University of Illinois, Chicago

30. Levit, Creon
NASA - Ames

31. Marcus, Marvin
University of California, Santa Barbara

32. Marsden, Jerry
University of California, Berkeley

33. Meyer, George
NASA - Ames

34. Nichols, William
University of California, San Diego

35. Odlyzko, Andrew
    AT & T Bell Laboratories

36. Olwell, Kevin
    Lawrence Livermore National Laboratory

37. Patton, Charles
    Hewlett-Packard Company

38. Phelps, Andrew
    University of California, Berkeley

39. Rand, Richard
    Cornell University

40. Sastry, Shankar
    University of California, Berkeley

41. Soiffer, Neil
    Tektronix, Inc.

42. Sussman, Gerald
    Massachusetts Institute of Technology

43. Thomas, Oran
    University of California, San Diego

44. Tuljapurkar, S.
    University of California, Berkeley

45. Wang, Shi-Ho
    University of California, Davis

46. Yang, Yumin
    University of California, San Diego

Concluding Remarks

The response of the participants in the months following the workshop indicates they found the sessions very useful. With the wider audience to be reached by the proceedings, there may be still more fruitful results.